United States Department of the Interior

FISH AND WILDLIFE SERVICE
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IN REPLY REFER TO:
FWS/R4/ES-JAFL

May 2, 2000

Mr. E. Alexander Stokes III
45 CES/CEV
1224 Jupiter Street, MS-9125
Patrick AFB, Florida 32925-3343

FWS Log No: 00-545

Dear Mr. Stokes:

This document transmits the Fish and Wildlife Service's (Service) revised biological opinion based on our review of historical and future light management activities by the 45th Space Wing (45th SW) of the U.S. Air Force at the Cape Canaveral Air Force Station (CCAFS) and Patrick Air Force Base (PAFB) in Brevard County, Florida, and their effects on sea turtles in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). A complete administrative record of this consultation is on file at this office.

CONSULTATION HISTORY

On April 13, 1988, Mr. Earl Possardt, the Service's Southeastern Sea Turtle Coordinator, met with several representatives of CCAFS to discuss proposed security upgrade lighting for LC17, LC40, and LC41 and the sea turtle hatchling disorientation and misorientation problem. An August 15, 1988, letter from the Service to the 45th SW reiterated our concerns and the need for compliance with section 7 of the Act. In a September 19, 1988, letter, the 45th SW indicated its desire to resolve the lighting and sea turtle conflicts at CCAFS as required under Act. Subsequently, it was agreed the 45th SW would develop light management plans (LMPs) for its launch complexes (LC) and other facilities at CCAFS in cooperation with the Service and submit them to the Service for consultation under section 7 of Act as required.

On September 29, 1989, the 45th SW submitted a LMP for LC36 to the Service, and a section 7 biological opinion was issued by this office on February 9, 1990. LMPs were subsequently provided to the Service for the Industrial Area, Vertical Integration Building and Gas Storage Area, Port Area, LC17, LC40, and LC41 on October 17, 1989. Revisions to the LMPs for LC17 and LC41 were provided on February 28, 1990, and revisions for the Port Area LMP on January 17, 1991. These six LMPs were approved by the Service and a section 7 biological opinion was

issued on April 9, 1991; a modification to this biological opinion was issued on November 13, 1991. In addition to requiring the 45th SW to implement all measures proposed in the LMPs, the Service had several additional requirements, including preparation of LMPs for all new construction at both CCAFS and PAFB.

On March 31, 1999, the Air Force requested a re-evaluation of the April 9, 1991, biological opinion for the incidental take of hatchling sea turtles on CCAFS.

At the request of the 45th SW, Don Palmer and Sandy MacPherson of this office met with 45th SW representatives on December 1, 1999, to review and discuss the most recent disorientation and misorientation data for hatchling sea turtles at CCAFS and PAFB and to determine whether reinitiation of consultation was warranted based on current levels of incidental take. At this meeting, tables and graphs of hatchling disorientation and misorientation events were presented to the Service to include in the administrative record. These tables and graphs included all disorientation/misorientation events recorded on CCAFS in 1999 regardless of whether CCAFS lights were responsible for these events or not. At this meeting, the Service informed the 45th SW that it was not accountable for those sea turtle disorientation/misorientation events attributable to lights at Port Canaveral and other nearby areas not under Air Force jurisdiction. Therefore, due to the need to clarify which disorientation/misorientation events the 45th SW is responsible for, the existence of new information that has become available since the 1991 biological opinions were issued, and changes in policy relative to sea turtle nest relocation by the Service and the Florida Fish and Wildlife Conservation Commission, the Service agreed that reinitiation of consultation was appropriate and a revised biological opinion should be issued.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The area involved in this biological opinion is the entirety of CCAFS and PAFB. The CCAFS has about 21 km of nesting beach and PAFB about 7 km of beach. As described above, seven LMPs were previously developed for the Industrial Area, Vertical Integration Building and Gas Storage Area, Port Area, LC17, LC36, LC40, and LC41 in an attempt to reduce or eliminate sea turtle hatchling disorientation/misorientation events. Facility custodians and managers are responsible for ensuring compliance of site personnel with operational constraints. Site security officers record noncompliance during routine security inspections/patrols, and the person responsible for the lights is notified. The 45th SW issues annual notices to all complex personnel prior to the sea turtle nesting season reminding tenants of light use requirements and responsibilities.

The previously issued Biological Opinions require the 45th SW to develop LMPs for all new construction and all facilities that currently do not have an LMP at CCAFS and PAFB for submittal to the Service for review and approval. The purpose of reinitiating consultation is to reevaluate the level of anticipated incidental take as a result of disorientation and misorientation, and modify if appropriate.

STATUS OF THE SPECIES

The reproductive strategy of sea turtles involves producing large numbers of offspring to compensate for the high natural mortality through their first several years of life. However, for over two decades, several human-caused mortality factors have contributed to the decline of sea turtle populations along the Atlantic coast and in the Gulf of Mexico (National Research Council 1990). These factors include commercial overutilization of eggs and turtles, incidental catches in commercial fishing operations, degradation of nesting habitat by coastal development (including the light pollution associated with coastal development), and marine pollution and debris. Therefore, human activities that affect the behavior and/or survivability of turtles on their remaining nesting beaches, particularly the few remaining high density nesting beaches, could seriously reduce our ability to conserve sea turtles.

Loggerhead Sea Turtle

The loggerhead sea turtle (*Caretta caretta*), listed as a threatened species on July 28, 1978 (43 FR 32800), inhabits the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. Loggerhead sea turtles nest within the continental U.S. from Louisiana to Virginia. Major nesting concentrations in the U.S. are found on the coastal islands of North Carolina, South Carolina, and Georgia, and on the Atlantic and Gulf coasts of Florida (Hopkins and Richardson 1984). Total estimated nesting in the Southeast is approximately 50,000 to 70,000 nests per year (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b).

Loggerheads are known to nest from one to seven times within a nesting season (Talbert *et al.* 1980, Richardson and Richardson 1982, Lenarz *et al.* 1981, among others); the mean is approximately 4.1 (Murphy and Hopkins 1984). The internesting interval varies around a mean of about 14 days (Dodd 1988). Mean clutch size varies from about 100 to 126 along the southeastern United States coast (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b). Remigration intervals of 2 to 3 years are most common in loggerheads, but the number can vary from 1 to 7 years (Dodd 1988).

From a global perspective, the southeastern U.S. nesting aggregation is of paramount importance to the survival of the species and is second in size only to that which nests on islands in the Arabian Sea off Oman (Ross 1982, Ehrhart 1989, National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b). The status of the Oman colony has not been evaluated recently, but its location in a part of the world that is vulnerable to disruptive events (e.g., political upheavals, wars, catastrophic oil spills) is cause for considerable concern (Meylan *et al.* 1995). The loggerhead nesting aggregations in Oman, the southeastern U.S., and Australia account for about 88 percent of nesting worldwide (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b). About 80 percent of loggerhead nesting in the southeastern U.S. occurs in six Florida counties (Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties) (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b).

Recent genetic analyses using restriction fragment analysis and direct sequencing of mitochondrial DNA (mtDNA) have been employed to resolve management units among loggerhead nesting cohorts of the southeastern U.S. (Bowen *et al.* 1993; B.W. Bowen, University of Florida, Gainesville, in litt., November 17, 1994, and October 26, 1995; Encalada *et al.* 1998). Assays of nest samples from North Carolina to the Florida Panhandle have identified three genetically distinct nesting subpopulations: (1) northern nesting subpopulation - Hatteras, North Carolina, to Cape Canaveral, Florida; (2) South Florida nesting subpopulation - Cape Canaveral to Naples, Florida; and (3) Florida Panhandle nesting subpopulation - Eglin Air Force Base and the beaches around Panama City, Florida. These data indicate that gene flow between the three regions is very low. If nesting females are extirpated from one of these regions, regional dispersal will not be sufficient to replenish the depleted nesting subpopulation (Bowen *et al.* 1993, B.W. Bowen, University of Florida, Gainesville, in litt., October 26, 1995).

Green Sea Turtle

The green sea turtle (*Chelonia mydas*) was federally listed as a protected species on July 28, 1978 (43 FR 32800). Breeding populations of the green turtle in Florida and along the Pacific Coast of Mexico are listed as endangered; all other populations are listed as threatened. The green turtle has a worldwide distribution in tropical and subtropical waters. Major green turtle nesting colonies in the Atlantic occur on Ascension Island, Aves Island, Costa Rica, and Surinam.

Within the U.S., green turtles nest in small numbers in the U.S. Virgin Islands and Puerto Rico, and in larger numbers along the east coast of Florida, particularly in Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a). Nesting also has been documented along the Gulf coast of Florida on Santa Rosa Island (Okaloosa and Escambia Counties) and from Pinellas County through Collier County (Florida Fish and Wildlife Conservation Commission, unpubl. data). Green turtles have been known to nest in Georgia and South Carolina, but only on rare occasions (Georgia Department of Natural Resources, unpubl. data; S. Murphy, South Carolina Department of Natural Resources, pers. comm., 1996). The green turtle also nests sporadically in North Carolina (North Carolina Wildlife Resources Commission, unpubl. data). Unconfirmed nesting of green turtles in Alabama has also been reported (R. Dailey, Bon Secour National Wildlife Refuge, pers. comm., 1995).

Green turtles deposit from one to nine clutches within a nesting season, but the overall average is about 3.3. The internesting interval varies around a mean of about 13 days (Hirth 1997). Mean clutch size varies widely among populations. Average clutch size reported for Florida was 136 eggs in 130 clutches (Witherington and Ehrhart 1989). Only occasionally do females produce clutches in successive years. Usually 2, 3, 4, or more years intervene between breeding seasons (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a).

Leatherback Sea Turtle

The leatherback sea turtle (*Dermochelys coriacea*), listed as an endangered species on June 2, 1970 (35 FR 8491), nests on shores of the Atlantic, Pacific and Indian Oceans. Non-breeding animals have been recorded as far north as the British Isles and the Maritime Provinces of Canada

and as far south as Argentina and the Cape of Good Hope (Pritchard 1992). Nesting grounds are distributed circumglobally, with the Pacific Coast of Mexico supporting the world's largest known concentration of nesting leatherbacks. The largest nesting colony in the wider Caribbean region is found in French Guiana, but nesting occurs frequently, although in lesser numbers, from Costa Rica to Columbia and in Guyana, Surinam, and Trinidad (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992, National Research Council 1990).

The leatherback regularly nests in the U.S. in Puerto Rico, the U.S. Virgin Islands, and along the Atlantic coast of Florida as far north as Georgia (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992). Leatherback turtles have been known to nest in Georgia, South Carolina, and North Carolina, but only on rare occasions (B. Winn, Georgia Department of Natural Resources, pers. comm., 1996; S. Murphy, South Carolina Department of Natural Resources, pers. comm., 1996; R. Boettcher, North Carolina Wildlife Resources Commission, pers. comm., 1998). Leatherback nesting also has been reported on the northwest coast of Florida (LeBuff 1990; Florida Fish and Wildlife Conservation Commission, unpubl. data); a false crawl (non-nesting emergence) has been observed on Sanibel Island (LeBuff 1990).

Leatherbacks nest an average of five to seven times within a nesting season, with an observed maximum of 11 (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992). The internesting interval is about 9 to 10 days. Clutch size averages 101 eggs on Hutchinson Island, Florida (Erik Martin, pers. comm.). Most leatherbacks remigrate at 2 to 3-year intervals based on data from the Sandy Point National Wildlife Refuge, St. Croix, U.S. Virgin Islands (McDonald and Dutton 1996).

Hawksbill Sea Turtle

The hawksbill sea turtle (*Eretmochelys imbricata*) was listed as an endangered species on June 2, 1970 (35 FR 8491). The hawksbill is found in tropical and subtropical seas of the Atlantic, Pacific, and Indian Oceans. The species is widely distributed in the Caribbean Sea and western Atlantic Ocean. Within the continental U.S., hawksbill sea turtle nesting is rare and is restricted to the southeastern coast of Florida (Volusia through Dade Counties) and the Florida Keys (Monroe County) (Meylan 1992, Meylan *et al.* 1995). However, hawksbill tracks are difficult to differentiate from those of loggerheads and may not be recognized by surveyors. Therefore, surveys in Florida likely underestimate actual hawksbill nesting numbers (Meylan *et al.* 1995). In the U.S. Caribbean, hawksbill nesting occurs on beaches throughout Puerto Rico and the U.S. Virgin Islands (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1993).

Hawksbills nest on average about 4.5 times per season at intervals of approximately 14 days (Corliss *et al.* 1989). In Florida and the U.S. Caribbean, clutch size is approximately 140 eggs, although several records exist of over 200 eggs per nest (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1993). On the basis of limited information, remigration intervals of 2 to 3 years appear to predominate.

ENVIRONMENTAL BASELINE

STATUS OF THE SPECIES IN THE ACTION AREA

Loggerhead Sea Turtle

The loggerhead sea turtle nesting and hatching season for Southern Florida Atlantic beaches (includes Brevard through Dade Counties) extends from March 15 through November 30. Incubation ranges from about 45 to 70 days. Between 2,346 and 3,512 loggerhead nests were deposited annually on CCAFS and between 1,297 and 1,993 on PAFB from 1994 through 1998 (Florida Fish and Wildlife Conservation Commission, unpubl. data).

Green Sea Turtle

The green sea turtle nesting and hatching season for Southern Florida Atlantic beaches (includes Brevard through Dade Counties) extends from May 1 through November 30. Incubation ranges from about 45 to 75 days. Between 7 and 104 green turtle nests were deposited annually on CCAFS and between 1 and 35 on PAFB from 1994 through 1998 (Florida Fish and Wildlife Conservation Commission, unpubl. data).

Leatherback Sea Turtle

The leatherback sea turtle nesting and hatching season for Southern Florida Atlantic beaches (includes Brevard through Dade Counties) extends from February 15 through November 15. Incubation ranges from about 55 to 75 days. A total of 10 leatherback nests were deposited on CCAFS and 1 on PAFB from 1994 through 1998 (Florida Fish and Wildlife Conservation Commission, unpubl. data).

Hawksbill Sea Turtle

The hawksbill sea turtle nesting and hatching season for Southern Florida Atlantic beaches (includes Brevard through Dade Counties) extends from June 1 through December 31. Incubation lasts about 60 days. Although no hawksbill nests have ever been recorded in Brevard County, one was reported at the Canaveral National Seashore in Volusia County in 1982 (Meylan *et al.* 1995). Therefore, the potential exists for such an occurrence at CCAFS and PAFB.

EFFECTS OF THE ACTION

Direct effects

Artificial lighting can be detrimental to sea turtles in several ways. Field observations have shown a correlation between lighted beaches and reduced loggerhead and green sea turtle nesting (Mortimer 1982, Raymond 1984, Mattison *et al.* 1993). Experimental field work by Witherington (1992a) directly implicated artificial lighting in deterring sea turtles from nesting. In these experiments, both green and loggerhead turtles showed a significant tendency to avoid stretches of beach with artificial lights that have predominantly blue and green wavelengths.

Because adult females rely on visual brightness cues to find their way back to the ocean after nesting, those turtles that nest on lighted beaches may be disoriented by artificial lights and have difficulty finding their way back to the ocean. In the lighted-beach experiments described by Witherington (1992a), few nesting turtles returning to the sea were misdirected by lighting; however, those that were apparently spent a large portion of the night wandering in search of the ocean. In some cases, nesting females have ended up on coastal highways and been struck by vehicles. However, turtles returning to the sea after nesting are not misdirected nearly as often as hatchlings emerging on the same beaches (Witherington and Martin 1996).

Under natural conditions, hatchling sea turtles, which typically emerge from nests at night, move toward the brightest, most open horizon, which is over the ocean. However, when bright light sources are visible on the beach, they become the brightest spot on the horizon and attract hatchlings in the wrong direction, making them more vulnerable to predators, desiccation, entrapment in debris or vegetation, and exhaustion, and often luring them onto roadways and parking lots where they are run over. Artificial lights can also disorient hatchlings once they reach the water. Hatchlings have been observed to exit the surf onto land where lighting is nearby (Daniel and Smith 1947, Carr and Ogren 1960, Witherington 1986). Artificial beachfront lighting from buildings and streetlights is a well documented cause of hatchling disorientation (loss of bearings) and misorientation (incorrect orientation) on nesting beaches (McFarlane 1963, Philbosian, 1976, Mann 1978, Florida Fish and Wildlife Conservation Commission unpubl. data).

Extensive research has demonstrated that visual cues are the primary sea finding mechanism for hatchlings (Carr and Ogren 1960, Ehrenfeld and Carr 1967, Mrosovsky and Carr 1967, Mrosovsky and Shettleworth 1968, Dickerson and Nelson 1989, Witherington and Bjorndal 1991). Loggerhead, green, and hawksbill hatchlings demonstrate a strong preference for short-wavelength light (Witherington and Bjorndal 1991, Witherington 1992b). Green and hawksbill turtles were most strongly attracted to light in the near-ultraviolet to yellow region of the spectrum and were weakly attracted or indifferent to orange and red light. Loggerheads were most strongly attracted to light in the near-ultraviolet to green region and showed differing responses to light in the yellow region of the spectrum depending on light intensities. At intensities of yellow light comparable to a full moon or a dawn sky, loggerhead hatchlings showed an aversion response to yellow light sources, but at low, nighttime intensities, loggerheads were weakly attracted to yellow light.

Although the attributes that can make a light source harmful to sea turtles are complex, a simple rule has proven useful in identifying problem lighting: "An artificial light source is likely to cause problems for sea turtles if light from the source can be seen by an observer standing anywhere on the beach" (Witherington and Martin 1996). If any glowing portion of a luminaire (including the lamp, globe, or reflector) is directly visible on the beach, then this source of light is likely to be a problem for sea turtles. But light may also reach the beach indirectly by reflecting off buildings or trees that are visible from the beach. Bright or numerous sources of lights, especially those directed upward, will illuminate sea mist and low clouds, creating a distinct sky glow visible from the beach. Field research suggests natural hatchling dispersal patterns may be disrupted by the glow from heavily lighted coastal areas (Witherington 1991).

Hatchling disorientation and misorientation incidents are well documented on CCAFS and PAFB. However, since the tracks of hatchlings are easily obscured by rain or windblown sand, the actual number of hatchling disorientation/misorientation incidents may be higher than what is actually observed and reported. Use of a standard monitoring and reporting protocol for disorientations/misorientations and estimating the percentage of all nests laid that are misdirected on an annual basis can be useful in assessing the success of light management activities.

Prior to implementation of approved LMPs and an internal light management policy, hatchlings from 4.4 percent of nests laid on CCAFS and Merritt Island National Wildlife Refuge in 1988 and 0.6 percent in 1989 were estimated to have been disoriented or misoriented by CCAFS lights. Hatchling disorientation and misorientation incidents recorded at PAFB in 1988 and 1989 were 0 and 0 percent, respectively, of all nests laid on PAFB.

Following implementation of approved LMPs and an internal light management policy, hatchlings from 0.005 percent of nests laid on CCAFS and Merritt Island National Wildlife Refuge in 1998 and 0.007 percent in 1999 were estimated to have been disoriented or misoriented by CCAFS lights. Hatchling disorientation and misorientation incidents recorded at PAFB in 1998 and 1999 were 0 and 0 percent, respectively, of all nests laid on PAFB.

Prior to implementation of approved LMPs and an internal light management policy, over 4,000 artificial lights were associated with the facilities described above and contributed to the illumination of the nesting beach and light glow affecting CCAFS, PAFB, and adjacent nesting beaches. Incandescent, high pressure sodium, quartz, and mercury vapor lights were commonly used lights at CCAFS and PAFB facilities. These types of lights emit high levels of blue and green wavelengths and consequently present the greatest potential for deterring nesting activities and causing hatchling disorientations and misorientations. Light management at CCAFS and PAFB has resulted in a significant number of lights being converted to low pressure sodium lights, which are monochromatic and emit only yellow wavelengths. Although these lights could still cause some hatchling disorientations or misorientations if they are close to the beach and their lamps, globes, or reflectors are visible from the beach, they are much less likely to adversely impact nesting activities or hatchlings, particularly if they are shielded. In addition, many lights have been eliminated, replaced with cutoff shoebox fixtures, and/or shielded.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The Service is not aware of any cumulative effects in the project area.

CONCLUSION

After reviewing the current status of the loggerhead, green, leatherback, and hawksbill sea turtles, the environmental baseline for the action area, the effects of the proposed project, and the cumulative effects, it is the Service's biological opinion that the project, as proposed, is not likely

to jeopardize the continued existence of these species and is not likely to destroy or adversely modify designated critical habitat. No critical habitat has been designated for the sea turtles in the continental United States; therefore, none will be affected.

It is our opinion that considering the measures the 45th SW has implemented and will be implementing to minimize direct lighting of the nesting beaches and background lighting glow at CCAFS and PAFB, the proposed project is not likely to jeopardize the continued existence of listed sea turtles. We do, however, believe that adverse impacts to sea turtles will continue although at a reduced level from lighting sources essential for human safety and national security at CCAFS and PAFB. We believe the reasonable and prudent measures provided with the incidental take statement below will effectively reduce the take of sea turtles.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered or threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be implemented by the Air Force's 45th SW so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The 45th SW has a continuing duty to regulate the activity covered by this incidental take statement. If the 45th SW (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the 45th SW must report the progress of the action and its impacts on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

The Service anticipates that up to a total of 2 percent of all hatchlings from all sea turtle nests laid annually and all females nesting at each installation (CCAFS and PAFB) could be taken as a result of this proposed action. The incidental take is expected to be in the form of hatchling and nesting female disorientations and misorientations. The 45th SW will be held responsible for disorientation or misorientation incidents caused by 45th SW lighting only, including those

disorientation and misorientation incidents that might occur on Merritt Island National Wildlife Refuge as a result of CCAFS lighting. Areas south of kilometer 8 will be attributed to the glow produced by lights at Port Canaveral and nearby towns.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of sea turtles.

1. Compliance monitoring shall be conducted to ensure operational constraints of approved LMPs at CCAFS and the light management policies at CCAFS and PAFB are being followed.

2. LMPs will be developed for all remaining facilities in accordance with the respective light management policies at CCAFS and PAFB and submitted to this office for approval.

3. LMPs will be developed for all new construction at CCAFS and PAFB and submitted to this office for approval.

4. Nesting surveys and monitoring of beaches for hatchling disorientation or misorientation incidents will continue at CCAFS and PAFB.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the 45th SW must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. Facility custodians and managers at CCAFS and PAFB will be responsible for ensuring compliance of site personnel with operational constraints of approved LMPs. Site security officers will record noncompliance during routine security inspection/patrols, and the person responsible for the lights will be notified.

2. The 45th SW will issue annual notices to all personnel prior to the sea turtle nesting season reminding tenants of light use requirements and responsibilities.

3. Operational constraints will preclude use of exterior lights between 9 p.m. and dawn from May 1 through October 31 unless essential to support launch-related activities at active launch complexes.

4. Fifteen to twenty nighttime lighting surveys will be conducted at CCAFS and five to six at PAFB during the peak nesting and hatching period (May 1 through October 31) to ensure compliance with the LMPs and existing light management policies.

5. LMPs will be developed for all remaining facilities at CCAFS and PAFB in accordance with the light management policies for each base, and submitted to this office for review and approval on a case-by-case basis.

6. LMPs will be developed for all new construction at CCAFS and PAFB and submitted to this office for review and approval prior to the commitment of funding or other contractual obligations.

7. Surveys will continue annually at CCAFS and PAFB to record nesting activities and hatchling disorientation and misorientation events to evaluate the effectiveness of the LMPs and identify needed modifications. Survey personnel must be experienced and trained in survey methodology and hold a valid Florida Fish and Wildlife Conservation Commission marine turtle permit.

8. Green turtle and leatherback nests that are located in areas where hatchling disorientations or misorientations are known to occur will be protected from exterior lights by using visual shields when needed.

9. The 45th SW will request budgetary funding for dune enhancement and native vegetation plantings to provide additional light screening of beach areas with a history of high levels of hatchling disorientation and/or misorientation incidents.

In the event disoriented or misoriented hatchlings are discovered, the following procedures shall be followed:

1. Live hatchlings shall be maintained in covered, rigid walled containers on moist sand in a building protected from extremes of heat or cold. Hatchlings shall be released after dark on the first night subsequent to the disorientation/misorientation event if their health status permits.

2. Dead hatchlings shall be preserved in formalin (1 part formalin:9 parts water). The body cavity should also be injected with formalin. Contact the U.S. Fish and Wildlife Service's Jacksonville Field Office at 904/232-2580 for disposition of hatchlings.

3. A Florida Fish and Wildlife Conservation Commission "Marine Turtle Hatchling Disorientation Incident Report Form" shall be completed for each disorientation/misorientation incident. These forms shall be submitted to U.S. Fish and Wildlife Service's Jacksonville Field Office on a monthly basis.

The Service believes that up to a total of 2 percent of all hatchlings from all nests laid annually and all females nesting at each installation (CCAFS and PAFB) will be incidentally taken as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Appropriate native salt-resistant dune vegetation to serve as light barriers should be established on the restored dunes. The Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems, can provide technical assistance on the specifications for design and implementation.

2. Educational signs should be placed where appropriate at beach access points explaining the importance of the area to sea turtles and/or the life history of sea turtle species that nest in the area.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in the request for reinitiation. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances

where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Sincerely yours,

for David L. Hankla
Field Supervisor

cc: Robbin Trindell, Florida Fish and Wildlife Conservation Commission, Tallahassee, FL
Ron Hight, Merritt Island National Wildlife Refuge, Titusville, FL
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LITERATURE CITED

Bowen, B., J.C. Avise, J.I. Richardson, A.B. Meylan, D. Margaritoulis, and S.R. Hopkins-Murphy. 1993. Population structure of loggerhead turtles (*Caretta caretta*) in the northwestern Atlantic Ocean and Mediterranean Sea. Conservation Biology 7(4):834-844.

Carr, A., and L. Ogren. 1960. The ecology and migrations of sea turtles. 4. The green turtle in the Caribbean Sea. Bulletin of the American Museum of Natural History 121:1-48.

Corliss, L.A., J.I. Richardson, C. Ryder, and R. Bell. 1989. The hawksbills of Jumby Bay, Antigua, West Indies. Pages 33-35 *in* Eckert, S.A., K.L. Eckert, and T.H. Richardson (compilers). Proceedings of the Ninth Annual Workshop on Sea Turtle Conservation and Biology. NOAA Technical Memorandum NMFS-SEFC-232.

Daniel, R.S., and K.U. Smith. 1947. The sea-approach behavior of the neonate loggerhead turtle (*Caretta caretta*). Journal of Comparative Physiology and Psychology 40:413-420.

Dickerson, D.D., and D.A. Nelson. 1989. Recent results on hatchling orientation responses to light wavelengths and intensities. Pages 41-43 *in* Eckert, S.A., K.L. Eckert, and T.H. Richardson (compilers). Proceedings of the Ninth Annual Workshop on Sea Turtle Conservation and Biology. NOAA Technical Memorandum NMFS-SEFC-232.

Dodd, C.K., Jr. 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish and Wildlife Service, Biological Report 88(14). 110pp.

Ehrhart, L.M. 1989. Status report of the loggerhead turtle. Pages 122-139 *in* Ogren, L., F. Berry, K. Bjorndal, H. Kumpf, R. Mast, G. Medina, H. Reichart, and R. Witham (eds.). Proceedings of the Second Western Atlantic Turtle Symposium. NOAA Technical Memorandum NMFS-SEFC-226.

Ehrenfeld, D.W., and A. Carr. 1967. The role of vision in the sea-finding orientation of the green turtle (*Chelonia mydas*). Animal Behaviour 15:25-36.

Encalada, S.E., K.A. Bjorndal, A.B. Bolten, J.C. Zurita, B. Schroeder, E. Possardt, C.J. Sears, and B.W. Bowen. 1998. Population structure of loggerhead turtle (*Caretta caretta*) nesting colonies in the Atlantic and Mediterranean as inferred from mitochondrial DNA control region sequences. Marine Biology 130:567-575.

Hirth, H.F. 1997. Synopsis of the biological data on the green turtle *Chelonia mydas* (Linnaeus 1758). U.S. Fish and Wildlife Service, Biological Report 97(1). 120pp.

Hopkins, S.R., and J.I. Richardson, eds. 1984. Recovery plan for marine turtles. National Marine Fisheries Service, St. Petersburg, FL. 355pp.

LeBuff, C.R., Jr. 1990. The loggerhead turtle in the eastern Gulf of Mexico. Caretta Research, Inc., Sanibel Island, FL. 236pp.

Lenarz, M.S., N.B. Frazer, M.S. Ralston, and R.B. Mast. 1981. Seven nests recorded for loggerhead turtle *(Caretta caretta)* in one season. Herpetological Review 12(1):9.

Mann, T.M. 1977. Impact of developed coastline on nesting and hatchling sea turtles in Southeastern Florida. Unpubl. M.S. thesis. Florida Atlantic University, Boca Raton. 100pp.

Mann, T.M. 1978. Impact of developed coastline on nesting and hatchling sea turtles in Southeastern Florida. Florida Marine Research Publications 33:53-55.

Mattison, C., C. Burney, and L. Fisher. 1993. Trends in the spatial distribution of sea turtle activities on an urban beach (1981-1992). Pages 102-104 *in* Schroeder, B., and B. Witherington (eds.). Proceedings of the Thirteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFC-341.

McFarlane, R.W. 1963. Disorientation of loggerhead hatchlings by artificial road lighting. Copeia 1963:153.

McDonald, D.L., and P.H. Dutton. 1996. Use of PIT tags and photoidentification to revise remigration estimates of leatherback turtles (*Dermochelys coriacea*) nesting in St. Croix, U.S. Virgin Islands, 1979-1995. Chelonian Conservation and Biology 2(2):148-152.

Meylan, A. 1992. Hawksbill turtle *Eretmochelys imbricata*. Pages 95-99 *in* Moler, P.E. (ed.). Rare and Endangered Biota of Florida, Volume III. University Press of Florida, Gainesville.

Meylan, A., B. Schroeder, and A. Mosier. 1995. Sea turtle nesting activity in the State of Florida 1979-1992. Florida Marine Research Publications Number 52, St. Petersburg. 51pp.

Mortimer, J.A. 1982. Factors affecting beach selection by nesting sea turtles. Pages 45-51 *in* Bjorndal, K.A. (ed.). Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington, D.C.

Mrosovsky, N., and A. Carr. 1967. Preference for light of short wavelengths in hatchling green sea turtles, *Chelonia mydas*, tested on their natural nesting beaches. Behaviour 28(3-4):217-231.

Mrosovsky, N., and S.J. Shettleworth. 1968. Wavelength preferences and brightness cues in the water finding behaviour of sea turtles. Behaviour 32(4):211-257.

Murphy, T.M., and S.R. Hopkins. 1984. Aerial and ground surveys of marine turtle nesting beaches in the southeast region. Final report to NMFS-SEFC. 73pp.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1991a. Recovery plan for U.S. population of Atlantic green turtle (*Chelonia mydas*). National Marine Fisheries Service, Washington, D.C. 52pp.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1991b. Recovery plan for

U.S. population of loggerhead turtle (*Caretta caretta*). National Marine Fisheries Service, Washington, D.C. 64pp.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1992. Recovery plan for leatherback turtles (*Dermochelys coriacea*) in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. 65pp.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1993. Recovery plan for hawksbill turtle (*Eretmochelys imbricata*) in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, St. Petersburg, FL. 52pp.

National Research Council. 1990. Decline of the sea turtles: causes and prevention. National Academy Press, Washington, D.C. 259pp.

Philbosian, R. 1976. Disorientation of hawksbill turtle hatchlings (*Eretmochelys imbricata*) by stadium lights. Copeia 1976:824.

Pritchard, P.C.H. 1992. Leatherback turtle *Dermochelys coriacea*. Pages 214-218 *in* Moler, P.E. (ed.). Rare and Endangered Biota of Florida, Volume III. University Press of Florida, Gainesville.

Raymond, P.W. 1984. The effects of beach restoration on marine turtles nesting in south Brevard County, Florida. Unpubl. M.S. thesis. University of Central Florida, Orlando. 121pp.

Richardson, J.I., and T.H. Richardson. 1982. An experimental population model for the loggerhead sea turtle (*Caretta caretta)*. Pages 165-176 *in* Bjorndal, K.A. (ed.). Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington, D.C.

Ross, J.P. 1982. Historical decline of loggerhead, ridley, and leatherback sea turtles. Pages 189-195 *in* Bjorndal, K.A. (ed.). Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington, D.C.

Talbert, O.R., Jr., S.E. Stancyk, J.M. Dean, and J.M. Will. 1980. Nesting activity of the loggerhead turtle *(Caretta caretta)* in South Carolina I: A rookery in transition. Copeia 1980(4):709-718.

Witherington, B.E. 1986. Human and natural causes of marine turtle clutch and hatchling mortality and their relationship to hatchling production on an important Florida nesting beach. Unpubl. M.S. thesis. University of Central Florida, Orlando. 141pp.

Witherington, B.E. 1991. Orientation of hatchling loggerhead turtles at sea off artificially lighting and dark beaches. Journal of Experimental Marine Biology and Ecology 149(1991):1-11.

Witherington, B.E. 1992a. Behavioral responses of nesting sea turtles to artificial lighting.

Herpetologica 48:31-39.

Witherington, B.E. 1992b. Sea-finding behavior and the use of photic orientation cues by hatchling sea turtles. Ph.D. Dissertation, University of Florida, Gainesville. UMI Dissertation Information Service, Ann Arbor. 241pp.

Witherington, B.E. and K.A. Bjorndal. 1991. Influences of artificial lighting on the seaward orientation of hatchling loggerhead turtles (*Caretta caretta*). Biological Conservation 55:139-149.

Witherington, B.E., and L.M. Ehrhart. 1989. Status and reproductive characteristics of green turtles (*Chelonia mydas*) nesting in Florida. Pages 351-352 *in* Ogren, L., F. Berry, K. Bjorndal, H. Kumpf, R. Mast, G. Medina, H. Reichart, and R. Witham (eds). Proceedings of the Second Western Atlantic Turtle Symposium. NOAA Technical Memorandum NMFS-SEFC-226.

Witherington, B.E., and R.E. Martin. 1996. Understanding, assessing, and resolving light-pollution problems on sea turtle nesting beaches. Florida Department of Environmental Protection FMRI Technical Report TR-2. 73pp.